Intermediate General and Applied Science

Biology Module: Lab Manual

Developed by Christine Miller © 2018

Table of Contents

Getting to Know Your Lab Manual

Each lab is designed to include a pre-lab reading and assignment, 3 activities, and then a post-lab assignment. The pre-lab reading needs to be completed **before** you come to lab. The pre-lab assignment is due at the beginning of the lab and includes questions and activities based on the pre-lab reading. The three lab activities are designed to fit into a two-hour lab. The post-lab assignments are typically due within the week after the lab has been completed. However, due dates are ultimately set by your instructor.

Being familiar with the symbols in your lab manual will help you know what you are supposed to be doing during specific lab activities. There are symbols in this manual that indicate which type of activity is required. Below is a table summarizing these symbols:

Symbol	You should:
MARK: _____ **10**	This symbol is included on the pages that will be handed in for marks. These pages will be either a pre- or post-lab assignment, and your instructor will let you know when it is due.
?	A simple question mark next to any of the text in your lab manual means that you are supposed to be thinking about the question being asked, but that you don't need to record an answer.
 Pencil icon attribution: binameusl. (2010) Grey Pencil. Openclipart. Retrieved from: https://openclipart.org/detail/82471/grey-pencil	This icon means that there is a question in your lab manual that you need to answer in writing in the space provided.
 Raised hand icon attribution: Dripsandcastle (2012) Raised Hand in Silhouette. Retrieved from: https://openclipart.org/detail/167372/raised-hand-in-silhouette	This icon means that before proceeding, you need to check in with your instructor.

Lab 1: Safety and the Microscope

Pre-Lab Reading

Safety: Student Copy

Safety in the lab is a serious issue. Some of the equipment and chemicals we use can be harmful if safety rules are not followed. Here are some guidelines to help you and others stay safe in the lab:

Plan Ahead	•Read your lab ahead of time. •Ask any questions before you start.
Stay Organized	•Keep your lab bench clear of unneccesary items. •Know ahead of time where safety equiment is in the lab.
Protect yourself	•Know where all safety equipment is in the lab. •Wear a lab coat at all times, and safety goggles as required. •If you get a chemical on your skin, rinse it immediately with plenty of water. •Do not eat or drink in the lab.
Report Accidents	•Let your teacher know right away if you spill something, break something, or get hurt.
Use Equipment Properly	•Be careful of cords, and unplug them properly. •Handle hot items with the approriate tools. •If you're not sure how to use/store something, just ask your instructor.
Clean Up Afterwards	•Put everything away. •Clean your glassware and leave it to dry. •Wipe down your work area. •Wash your hands.

In a biology lab, there are often places to dispose of specific types of waste. For example, a broken glass beaker would be disposed of in the “sharps” container, but a live-culture slide of bacteria would be disposed of in the “biohazard” bin. Some waste materials can go down the sink in or the regular garbage can, but others may have to be sent away to be specially treated before being disposed of. If you are ever not sure about where to dispose of something, ask your instructor.

I understand the safety rules listed above and agree to follow them: (Student copy)

Signature: _____ Print Name: _____ Date: _____

Safety: Instructor Copy

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Signature: _____ Print Name: _____ Date: _____

The Compound Light Microscope

The compound light microscope is a very important tool in the field of Biology. The term *microscope* literally means "to view something tiny". The compound light microscope allows us to observe living things that are too small to see with the naked eye. Light microscopes use lenses to magnify what we see. Lenses were first developed in the first century AD and the first microscope was developed by Anton van Leeuwenhoek so he could look at microorganisms in pond water.

The microscopes we will use in lab a termed *compound* because light passes through two lenses- the *ocular lens* and the *objective lenses.*

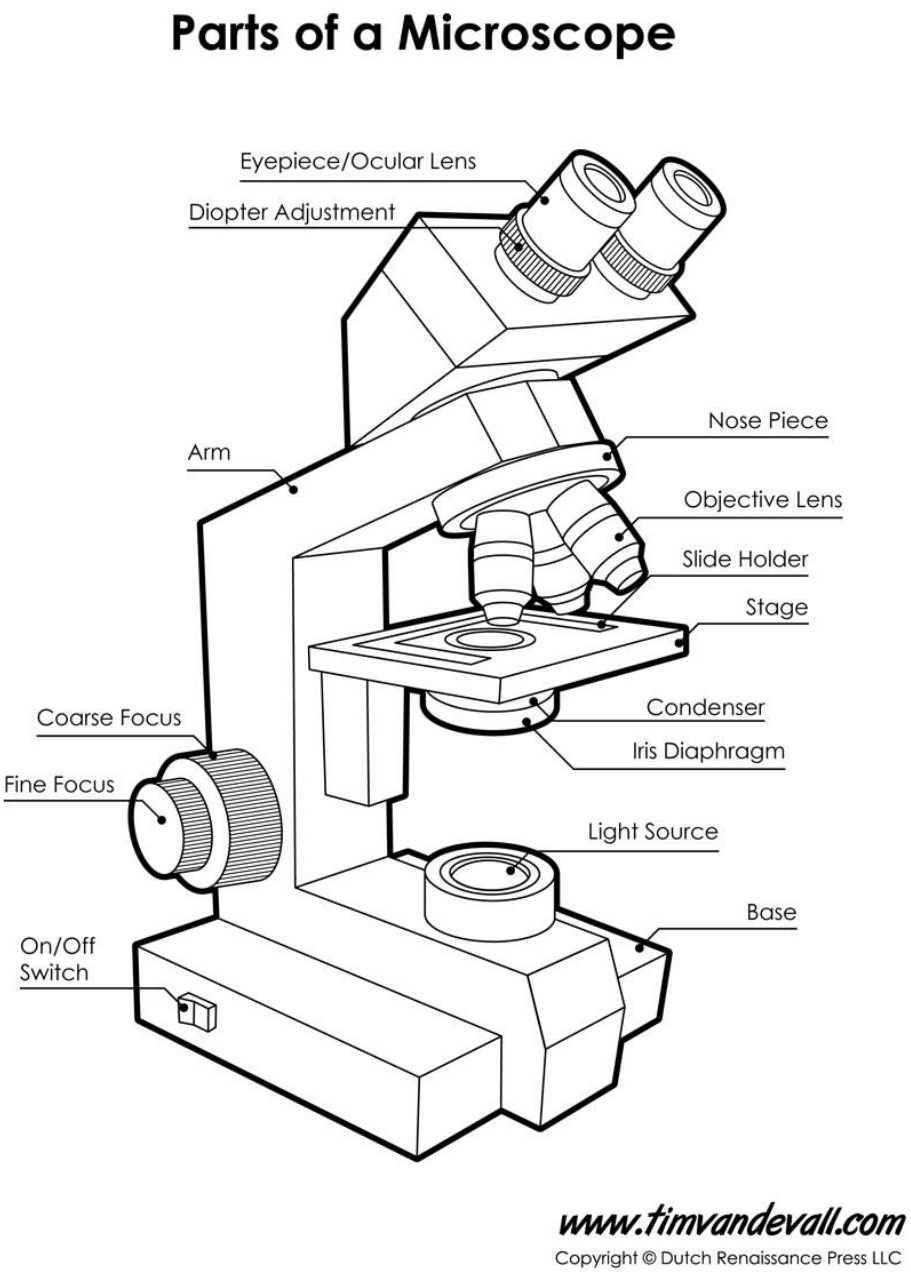


Image used with permission of author.

Parts of the Microscope

It is important to get to know your microscope really well so that you can get the best use out of it. Here are the functions of many of the parts labelled in the diagram from the previous page:

Parts of the Microscope	
Part	**Function**
Ocular Lens	• the part of the microscope you look through when examining your slide • provides 10X magnification
Arm	• the part of the microscope you hold when you are carrying it
Nosepiece	• holds the objective lenses • revolves to allow you to select any of the objective lenses

Objective Lenses	• four different lenses, with different magnifications
	  ○ 4x (scanning)
	  ○ 10x (low power)
	  ○ 40x (high power)
	  ○ 100x (oil immersion)

Coarse Focus	• used to focus your image when using scanning or low-power objective lens
Fine Focus	• used to focus your image when using high power or oil immersion objective lens
Stage	• flat surface you place your slide on
Stage Clips (Slide Holder)	• clip that holds your slide in place on the stage
Light Source	• emits light so that you can see what is on your slide
Iris Diaphragm	• controls the amount of light passing through the slide
Base	• heavy part of the microscope you hold with your hand underneath to help support its weight when carrying it
On/Off Switch	• controls whether your light source is on or off

Always use two hands when carrying a microscope: one hand holds the arm, and the other hand goes under the base to support its weight.

Pre-Lab Assignment

Name: _____

MARK:

_____

10

1. Why is it important to wear closed-toe shoes in the lab? (1)

2. Where in the lab would you dispose of bacteria? (1)

3. How should you carry your microscope? (2)

4. When should you use the fine focus knob? When should you use the coarse focus knob? (2)

5. Use arrows to match the microscope part to its function: (4)

Ocular Lens	holds the objective lenses
Stage Clip	regulates the amount of light
Nosepiece	holds the slide
Diaphragm	the part you look through

Activity 1: Getting to Know Your Microscope

The microscope is a tool that helps us see tiny things by magnifying them.

What are some other tools that you might use to magnify what you are seeing?

_____

_____

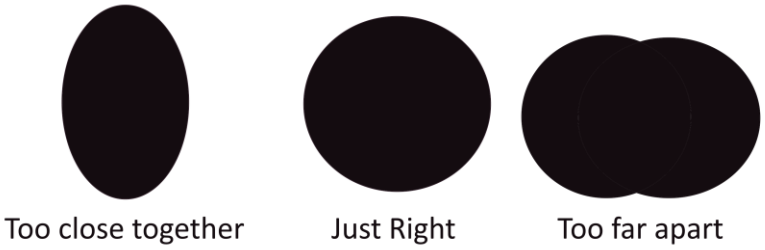
_____

Before turning on your microscope, work with a partner to identify all of the parts of the microscope in your diagram. Try:

- Sliding the ocular lenses closer together and further apart. Why do you think these are adjustable?
- Pulling the ocular lens up and off the microscope. Look through both ends (don't touch the lens though). Look through the lens from arm's length. What do you see?
- Turning the revolving nosepiece. Can you feel each objective lens "click" into place as you turn it? **Set the scanning power lens to the down position.**
- Using the light intensity dial to turn the intensity to level 5.

You are now ready to plug in your microscope and turn it on.

Look through the ocular lenses. Now set the ocular lens width to a setting that is comfortable for your eyes. You want to see a perfect circle in your *field of view*- the circle of light you see when looking into the microscope.



What is the number on the little number line between the ocular lenses?

This is your setting for anytime you use the microscope.

Take one of the slides of coloured threads from the front of the class. Place it on the stage, and hold it in place with the stage clips. Your slide should be resting directly on top of the stage. You can try moving the slide's position on the stage using the stage controls.

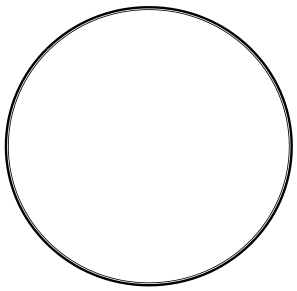
 What do the two stage control knobs do?

Use the stage controls to position the threads directly below your scanning power lens. Can you see the threads? If not, try using your coarse focus knob to get the image into focus. If you still cannot see your image, try using the stage controls to move your threads into the field of view.

Once you can see your threads in the field of view and they are in focus, try to position the place where the threads cross each other into the very center of your field of view.

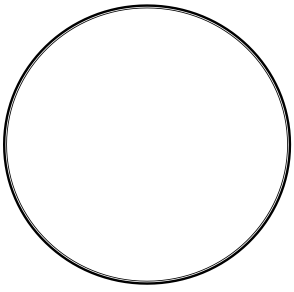
 Show your instructor before you move on.

 Draw a picture, in pencil, of what you see in your field of view on scanning power:



Now, use the revolving nosepiece to put the low power objective lens into the down position. Look through your ocular lens. What happened?

 Draw a picture of what you see in your field of view on low power:



As your magnification increases, your field of view decreases. This means that the higher your magnification, the tinier the area you are looking at on your slide.

Total Magnification	Field of View
40X (scanning power)	
100X (low power)	
400X (high power)	
1000X (oil immersion)	

You may have noticed in the table above that the total magnification is 10X what each of the objective lenses have as their magnification. This is because your ocular lenses **also** magnify your image and they have a magnification power of 10. Total magnification is calculated by multiplying the ocular lens magnification by the objective lens magnification.

Activity 2: Making Your Own Slide

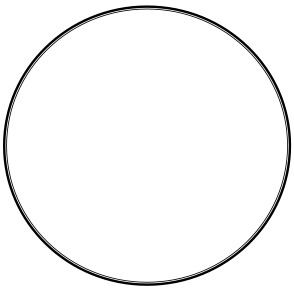
Biologists often have to make their own slides. The prepared slide of the coloured threads you used in the previous activity are termed “fixed mount” slides. This means that they are pre-prepared and are permanent. Fixed slides are important for studying living things, but they cannot actually show things that are still alive. In order to look at living organisms, you have to make what is termed a “wet mount” slide. This means a slide that is prepared at the time of use and typically includes a drop of liquid.

You will be making a slide of the letter “e”. Take a piece of newspaper; find and cut out a small print “e”. Place your tiny “e” on the middle of a clean, blank slide. Add a single drop of liquid onto the “e” and then place a cover slip on top. When adding the cover slip, touch one edge of the cover slip to the slide and then allow the other end to drop, as per the diagram below:

Source: Microscope slide and cover slip, by Witia. Wikimedia Commons. [CC BY 3.0 (https://creativecommons.org/licenses/by/3.0)]

Place your “e” slide on the stage, and make sure the scanning power objective lens is in the down position. Move your “e” into the field of view and focus it.

Draw your “e” below:



What do you notice about it? Why do you think it appears this way?

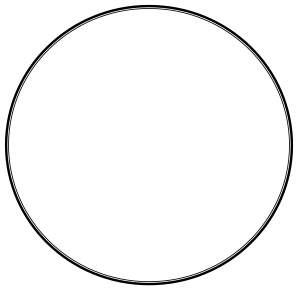
Adjust your stage controls to move the slide to the left on the stage. Which way did the image move in your field of view?

Adjust your stage controls to move the slide towards you on the stage. Which way did the image move in your field of view?

 How can you explain what has happened?

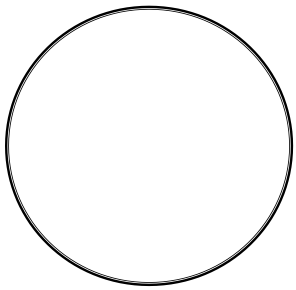
Center and focus your image and turn your revolving nosepiece to place the low power objective lens into the down position.

 Draw your “e” below. How does it compare to your drawing from scanning power?



What do you think will happen when you switch to high power? Center and focus your image and then move the high power objective lens into the down position. Remember, you *must* use the fine focus knob when using the high power objective lens.

 Draw your “e” below. Can you see the entire letter? Why or why not?



Activity 3: Biological Drawing

Being able to follow conventions to create a **biological drawing** is a very important skill for biologists. Creating a biological drawing is considered a type of data collection since it is a record of information about a particular organism. Drawings can help a biologist remember and share information about and features of a specimen. A biological drawing is not the same as a drawing you would make in your daily life, so there are some rules you have to follow when completing a biological drawing:

1. Use a pencil.
2. Draw on white, unlined paper.
3. Make clear lines- no shading or sketching.
4. Centre the drawing on the page, draw it large enough to fill about half of the space, but leave room for labels.
5. Label lines should be horizontal and drawn with a ruler; all label lines should be on the right side of the drawing and written in printing (not script).
6. Draw exactly what you see, not what you think you should see or you wish you could see. ☺
7. Make sure you keep looking back at your specimen while you are drawing so that your drawing is accurate.
8. Have a title at the top of the page. The title should state what has been drawn, and what objective lens you were using. The title should be centered and underlined.

You will be making a wet mount slide of the microorganism *Euglena.* Do an internet search to find out a little bit more about *Euglena.*

 What did you find out?

Obtain a clean, blank slide and add a few cotton ball fibers to it (these are to keep the microorganisms from swimming out of your field of view!). Add a drop of the *Euglena* culture. Now add your coverslip.

Place *Euglena* on your stage and view it on scanning power. At this magnification, the *Euglena* will look like tiny green dots. Focus, and then move to low power. Focus again and move to high power.

 Describe the movement of the *Euglena*

On the next page, **as part of your Post-Lab Assignment**, create a biological diagram of a single Euglena, following the instructions at the top of the page. **It is worth 10 marks.**

Post-Lab Assignment

Name: _____

MARK:
_____
20

1. Create a biological diagram of a single Euglena. (10 marks)

Don’t forget the questions on the next page! →

2. What are some problems you ran into when using your microscope? How did you fix/overcome these problems? (2 marks)

3. Which focus knob should you use when viewing a specimen under the oil immersion lens? (1 mark)

4. If your field of view is too small to see your entire specimen, what can you do to be able to see the entire thing? (1 mark)

5. What happens to your field of view as you increase magnification? (1 mark)

6. What is the difference between a fixed mount slide and a wet mount slide? (2 marks)

7. What types of tiny things would it be easiest to view under a compound light microscope? What types of tiny things would it be difficult to view under the compound light microscope? (2 marks)

8. When is it helpful to use the iris diaphragm to adjust the amount of light hitting your slide? (1 mark)

Lab 2: Biological Surveys

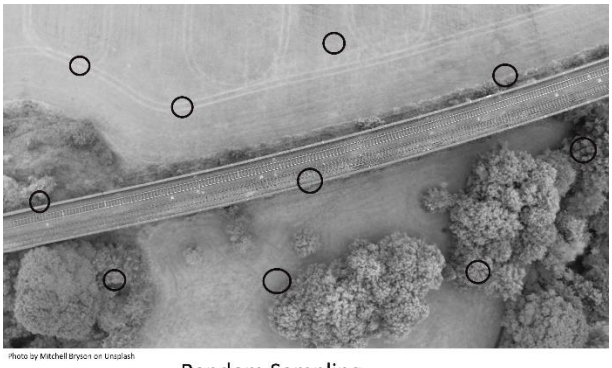
Pre-Lab Reading

Biosurveys

A biological survey, or **biosurvey**, is a scientific study of the organisms present in a particular area with the purpose of assessing the condition of an ecological resource. Biosurveys are used by organizations to make informed decisions about land use management and conservation of natural resources.

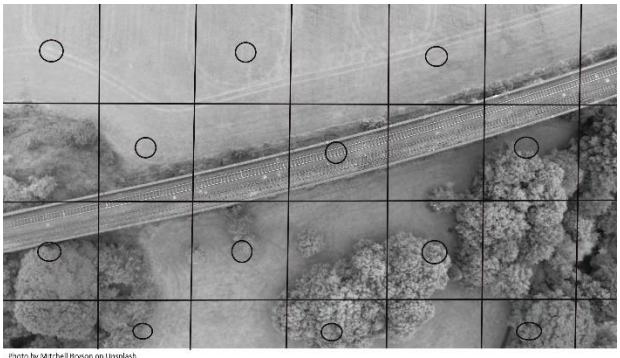
A biosurvey often involves collection and analysis of plant and/or animal samples. Often, an area is too large to catalogue every living thing in the area, so a strategy called **sampling** is used. When using this strategy a series of sample areas of a set size (called **quadrats**) are placed in the study area and the species within these set areas are recorded. With the combined information from several sample areas, a scientist should get a fairly accurate estimate of the number of species in an area.

There are several strategies to choose from when sampling a specific area with respect to where sample areas will be located. In **random sampling**, the quadrats are randomly placed in the area to be studied.



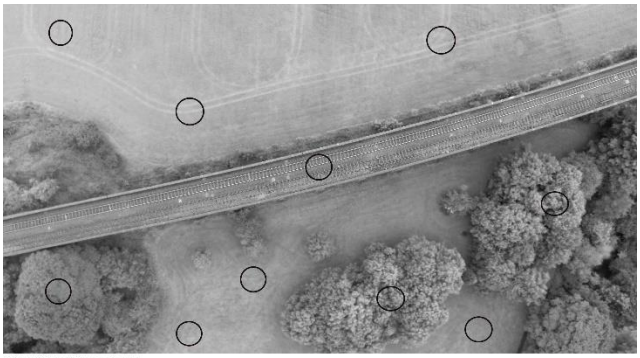
Random Sampling

In **systematic sampling**, quadrats are placed in a grid-like formation, regardless of land features



Systematic Sampling

In **stratified sampling**, the researcher divides the study area into zones which appear different and make sure quadrats are placed in each of these unique zones. In addition to having quadrats in each unique zone, the researcher tries to ensure that if 20% of the area is a specific zone, it receives 20% of the quadrats.



Stratified Sampling

Aerial photos by: Mitchell Bryson on Unsplash

Plant Identification

In this lab, we will be doing some sampling of the campus green spaces. In order to do this, we need to be able to identify the living things we may encounter as we conduct our biosurvey. Here are some of the plants you may find:

Name	Photo	Photo Attribution
Greater Plantain:		Greater Plantain by JonasS at the Lithuanian language, via Wikimedia Commons [CC-BY-SA-3.0 (http://creativecommons.org/licenses/by-sa/3.0/)],
Ox Eye Daisy		Ox-eye daisy - 2 (2000) [adapted] by Ion Chibzii from Chisinau, via Wikimedia Commons [CC BY-SA 2.0 (https://creativecommons.org/licenses/by-sa/2.0)]
White Clover		[Trifolium-repens]. The original uploader was Heron at English Wikipedia. (Transferred from en.wikipedia to Commons.) [CC-BY-SA-3.0 (http://creativecommons.org/licenses/by-sa/3.0/)]
Ryegrass		Grass Rush Juicy Green by Hans at Pixabay
Dandelion	 	Leaf: TaxicumLeaf by Greg Hume - Own work, via Wikimedia Commons [CC BY-SA 3.0 (https://creativecommons.org/licenses/by-sa/3.0)] DandelionFlower by Greg Hume - Own work, via Wikimedia Commons [CC BY-SA 3.0 (https://creativecommons.org/licenses/by-sa/3.0)] TaraxacumOfficinaleSeed [Seed head] by Greg Hume via Wikimedia Commons [CC BY-SA 3.0 (https://creativecommons.org/licenses/by-sa/3.0)],

Secwepemc Language in Ecology

In **Secwepemc** Language, hello is Weyt-k- pronounced Wait-k.

English Term	Secwepemc Term	Pronunciation
Dandelion	Kwelkwelqíqen	Kwel-kwel-kee-ken
Grass	kwlékwle	Kw-leh- kw-lah
Flower	sulé̓nsem	Soo-len-sum
Bug	pepíp̓7ese	Puh-peep-essah

Source: First Voices website - Secwepemc Word Categories at http://www.firstvoices.com/en/Secwepemc/word-categories

We often see the plants around us as resources, but to many Indigenous people, plants are seen as medicine. This medicinal knowledge of plants has been passed down and added to for thousands of years. Over a lifetime of mentoring, Indigenous peoples could become experts in the medicinal and practical uses of the plants in their area.

A few uses of plants local to BC include:

- Dandelion: roots and leaves are eaten to improve digestion. Sap is used as an insect repellant.
- Trembling Aspen: the white powder from the bark is transferred to skin as a sunscreen.
- Plantain: the leaves can be crushed and made into treat cuts and rashes.
- Chamomile: made into a tea to help cure insomnia.
- Sage: can be rubbed into the skin to be used as a deodorant and insect repellant.
- Stinging Nettle: leaves can be boiled to make a tea which helps with inflammation and pain.

Pre-Lab Assignment

Name: _____

MARK:
_____
10

1. What are some situations in which biosurveying would be helpful to a(an)
    a. conservation officer?

    b. city planner?

    c. rancher?

    d. oil and gas company?

2. We will be conducting a biosurvey of plants. What do you think would be some considerations that we would have to take into account if we were going to include animals in our survey? (2 marks)

3. What do you think the effect of urban expansion is on the biodiversity of an area? (1 mark)

4. Look up and define the term “monoculture.” What are the pros and cons of growing crops in a monoculture? (3 marks)

Activity 1: Plant Identification

Find a partner and then have a good look at the ground around you. Using your Plant Identification page, do you see any of these plants?


Which plant do you see most?


How are the plants grouped? E.g., are these plants grouped in clumps or separately?

Abiotic factors are the non-living things in an environment, such as rocks, soil, water, gases, minerals, etc. Discuss with your partner what abiotic factors you can see in the general area.

Biotic factors are the living things in an environment, such as plants, animals, fungi, protists and bacteria. Discuss with your partner what biotic factors you can see in the general area.

For the purpose of our lab, we are not including trees in our biosurvey. However, are there trees in the area? If so, do you know the type?


Choose a leaf or set of needles and draw it in this space. If you can find a cone or set of berries, include a drawing of this as well:

Activity 2: Recording Life

You will be working on your quadrats in groups of four.

Your quadrat is divided into 4 sections labelled as 1, 2, 3, and 4. It is your responsibility to identify and estimate the amount of each of the plants present in your section.

I am in a group with:	I am recording information for quadrant #:

Plants		Animals (if any)	
Type	**Percent of Coverage**	**Type**	**Number**

When you collected data in the plot study, you collected information about the living things you could see. You can represent information in several ways, but visual representations help people to understand the information you are presenting.


Create a bar graph of the percent of coverage for each of the plants in your quadrant:

Percent Coverage						
	100					
	90					
	80					
	70					
	60					
	50					
	40					
	30					
	20					
	10					
Types of Plants						

Activity 3: Sharing Data

When scientists are using plot information to make decisions about how to manage an ecosystem, they have to combine large amounts of information.

Now it is time to work in your group of four and find out what the average amount of plant coverage was, and how many animals were in your plot in total.

To find the **average** amount of vegetative cover, you add up each quadrant's percent coverage and divide it by four (because there are four quadrants).

Quadrant	Grass Coverage	Dandelion Coverage	Clover Coverage	Greater Plantain Coverage
Quadrant 1				
Quadrant 2				
Quadrant 3				
Quadrant 4				
Plot Average				

 How does your quadrant data differ from the overall plot data? (Did you have more or less of any of the plants than the average of the group?)

 Why do you think your quadrant had slightly different results than the plot average? What are some things that would affect which types of plants grow in a certain area?

Now it is time to share your plot information with the entire research team (your class). As a class, fill in the total amounts of animals found in each plot:

Group	Animal #1	Animal #2	Animal #3	Animal #4
Group 1				
Group 2				
Group 3				
Group 4				
Group 5				
Group 6				
Group 7				
Total				

How did your group's findings compare to the rest of the class? Did you have more or less of a certain kind of animal? Why do you think that is?

Post-Lab Assignment

Name: _____

MARK:
_____
10

1. What do you think your plant coverage would be like if you were in an area that was under a pine tree? (2 marks)

2. What do you think your plant coverage would be like if it were six months from now? (2 marks)

3. What do you think your plant coverage would be like if students used that area as a pathway? (2 marks)

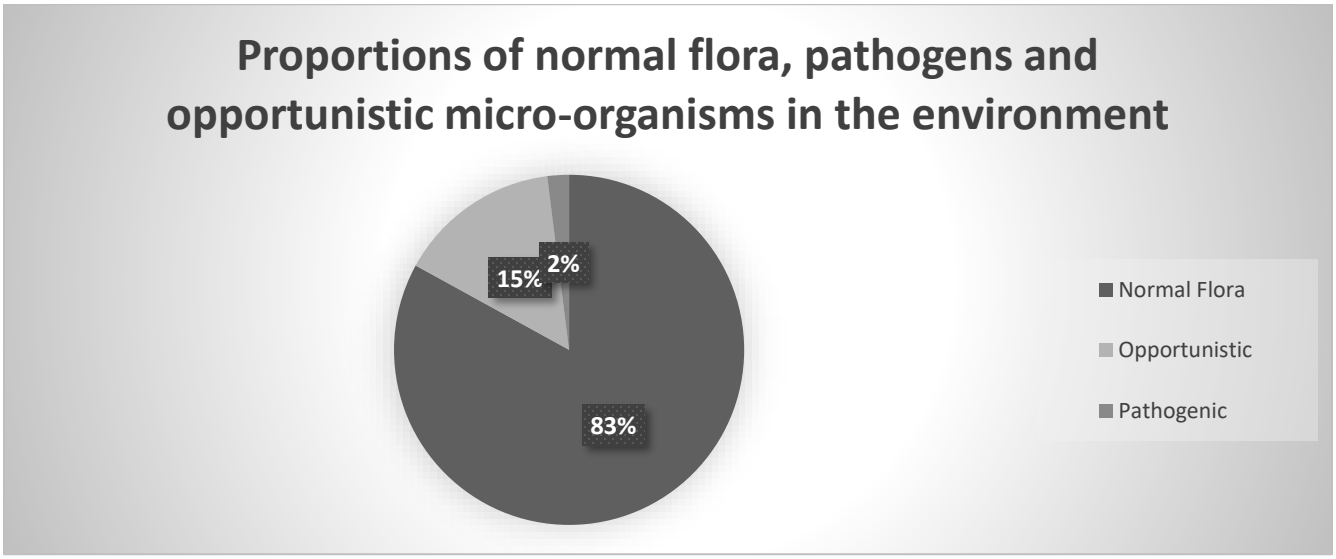
4. How do you think your animal count would change if you did your study at nighttime? (2 marks)

5. How do you think your animal count would change if you did your study six months from now? (2 marks)

Lab 3: Bacteria in the Environment

Pre-Lab Reading

Bacteria are **prokaryotic unicellular** living organisms. The most widely known bacteria are pathogenic, which means they cause disease. However, **pathogenic** bacteria make up a very small proportion of the types of bacteria in our environment. The vast majority of bacteria are **innocuous**, and many are in fact helpful to humans.



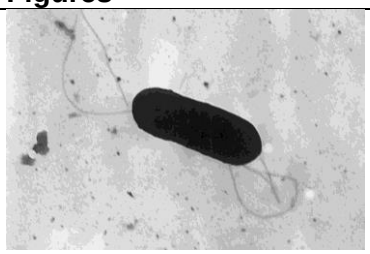
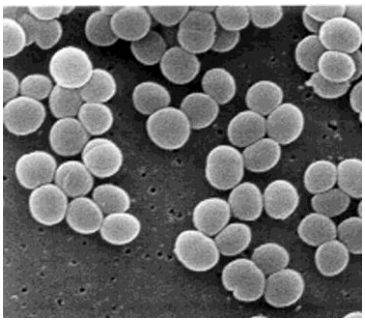
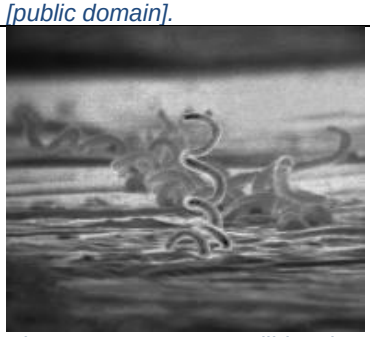
Bacteria are often used in the food industry. Cheese, yogurt, sauerkraut, soy sauce and dill pickles all have this in common. Coffee and cocoa beans also require bacteria in their processing before they are ready to be consumed.

Not only do bacteria make great food outside of your body, but they ensure that we are able to digest food once it is in our digestive tract. Most full grown adults have at least a kilogram of bacteria living in their small and large intestines and these bacteria produce vitamin B12 and vitamin K, as well as break down substances that we cannot digest on our own.

Bacteria are also a hugely important part of the nutrient cycle on earth. Certain types of bacteria are able to convert nitrogen and carbon dioxide from the air into molecules that animals and plants find useable. Some bacteria are used in industry to clean byproducts ranging from nuclear waste, to plastics, to oils—this is termed **bioremediation**.

Scientists at the University of Surrey in England conducted an experiment to determine how much and how many types of bacteria were lurking on their phones. The results showed that phones have a high number of types of bacteria, but that most of these types aren't disease causing. Another study found that cell phones have 10x the bacteria that can be found on toilet seats! A good way to cut down on bacterial infections is one of the simplest: proper and frequent handwashing.

Bacteria are typically smaller than eukaryotic cells and can be categorized a few ways. One way to categorize bacteria is based on their shape:

Category	Shape	Figures	Examples
Bacillus	Rod shaped	 Figure 1: Listeria monocytogenes bacterium, by Elizabeth White, via the Centers for Disease Control and Prevention's Public Health Image Library (PHIL), with identification number #2287 [public domain].	Salmonella Listeria Pseudomonas
Coccus	Spherical	 *Figure 2: Staphylococcus aureus bacteria [adapted], by Janice Haney Carr, via the Centers for Disease Control and Prevention's Public Health Image Library (PHIL), with identification number #6486 and 11153 [public domain].*	Streptococci Sarcina Gonorrhea
Spiral (helical)	Spiral	 *Figure 3: Reponema pallidum bacteria, CDC / Dr. David Cox via the Centers for Disease Control and Prevention; Public Health Image Library (PHIL), with identification number #1977 [public domain].*	Lyme Disease Syphilis

Pre-Lab Assignment

Name: _____

MARK:
_____
10

1. Connect the shape of bacteria to its name: (3 marks)

Cocci Spiral Bacillus

2. What percentage of bacteria are disease causing? What percent are opportunistic? (2 marks)

3. What are some ways bacteria are important for human health? (2 marks)

4. What are some ways bacteria are important for the environment? (2 marks)

5. What is a good way to prevent the spread of bacteria? (1 mark)

Activity 1: Good Bugs vs. Bad Bugs

Use information you find on the internet to classify the bacteria listed below into the helpful or harmful category and include a short description of why the bacteria belongs in that category.

Name of Bacteria	Helpful?	Harmful?	Reason
E. Coli			
Clostridium			
Lactobacillus			
Alcanivorax borkumensis			
Bifidobacterium			
Your choice:			

Activity 2: Ubiquitous Bacteria

Bacteria are ubiquitous, which means they are present everywhere. Today, we will be swabbing different areas in the lab and hallways to determine the presence of bacteria.

Where do you think there will be the most bacteria?

Where do you think there will be the least bacteria?

One way to determine how many bacteria are present on an object it to take a swab of a specific area and then grow them in prepared petri dishes. The petri dishes we will use contain **agar**, which is a special mix of the elements bacteria need to grow: water and nutrients. These petri dishes are then placed in a chamber called an **incubator**. This incubator keeps the contents of the petri dish warm and moist—bacteria's favourite growing conditions. After about 48 hours, the bacteria which used to be invisible to the naked eye have increased so much that you will be able to see them in clusters called colonies.

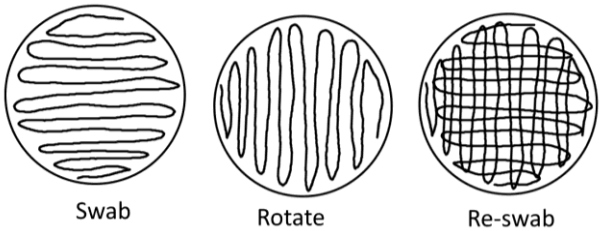
Your challenge is to grow the "grossest" petri dish. You will get the materials to swab 2 different places that you think contain the most bacteria and then in our next lab we will examine them and announce a "winner". There are, for safety reasons, a few swab sources that are out of bounds for this challenge: you MAY NOT swab the inside of a toilet or urinal, use any bodily fluids or products, and you may not use animal sources (especially feces, AKA poop).

You will need:
2 swabs
2 petri dishes
1 fine tip permanent marker

Note: Do not forget to label the lid of your petri dish with your name, lab section, and the area you will be swabbing.

To collect your sample:
Remove a sterile swab from the wrapper—do not touch the cotton-tipped end; handle it from the wooden end. Run your swab along the surface of the area you are swabbing—you can go over the same area several times, rotating the swab to make sure it is evenly covered.

To swab your petri dish:
Remove the lid from your petri dish. Hold the swab in one hand and the bottom of the plate (containing the agar) in the other. Run the swab lightly over the surface of the plate without scratching too deeply or gouging the surface of the agar—you do not need to apply very much pressure. You will swab the entire surface with a back and forth motion, turn the plate 90° and then repeat (see diagram).



Dispose of your swab in the biohazardous waste bin provided by your instructor. Place the lid back on top of your petri dish and return it to your instructor. Repeat for your second swab area.

The plates will be incubated and you will receive them back the next week to see your results.

Activity 3: Handwashing

You use your hands for so much—texting, typing, driving, eating, moving things around, wiping after you go to the bathroom…. It's no wonder that your hands can play a huge part in transmitting disease-causing bacteria.

Effective handwashing remains one of the best defenses against spreading germs and should be done frequently, particularly after using the washroom, doing laundry, and cooking or eating.

In this lab we will be using a product called Glo Germ™ which simulates the presence of bacteria on your hands. You will see how much "bacteria" you have on your hands prior to handwashing, and then how much this is reduced after handwashing.

Procedure:

1. Get warm water running in the sink and keep the soap close at hand.
2. Get a dime-sized amount of the Glo Germ™ product from your instructor.
3. Rub the product into your hands as though you were putting on hand lotion. Make sure you get the product in between your fingers, on the backs of your hands, and under your fingernails.
4. Shine the UV light over your hands to make sure you evenly distributed the product. Shade in the diagram below to show "bacterial" coverage.
5. Wash and dry your hands as you normally would.
6. Shine the UV light on your hands again. Look for any leftover bacteria, paying close attention to cuticles, underneath fingernails, in between fingers and the back of your hands. Shade in the diagram below to show any residual bacteria that is not removed by handwashing.

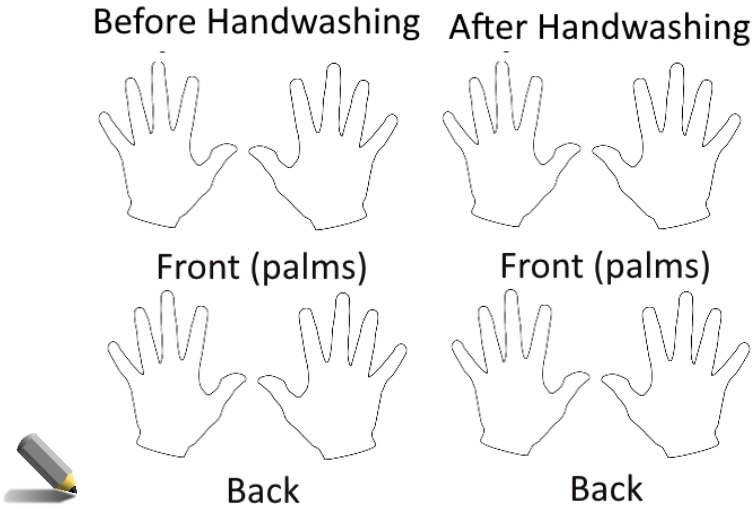


Figure 4: Hand Template by original uploader, Kenny sh at English Wikipedia or [CC-BY-SA-3.0 (http://creativecommons.org/licenses/by-sa/3.0/)], via Wikimedia Commons

Where is most of the residual "bacteria", not washed away by handwashing, located?

7. Now view a handwashing technique demonstration, "6-step hand cleaning technique" from Nottingham University Hospitals Infection Control (NUHInfectionControl), at https://bit.ly/2P1oNq0.
8. Wash your hands a second time, using the technique in the video. View your hands under the UV light again. Did this technique reduce the amount of residual "bacteria"?

_____

If so, estimate by what percentage the bacteria was reduced between your normal handwashing routine and the demonstrated technique (e.g., if the new technique washed away half of the residual "bacteria," then write 50%).

_____

Post-Lab Assignment

Name: _____

MARK:

_____

10

Choose an infectious disease caused by bacteria, research it, and then fill in the following elements of a report:

Name of Disease:

Name of disease-causing bacteria:

Transmission (how it is spread):

Symptoms:

Diagnosis and/or testing:

Treatment:

Statistics:

Other Information:

Sources:

-
-

Glossary

Abiotic: the non-living chemical and physical parts of an environment that affect living organisms and the ecosystem.

Agar: a jelly-like mixture of agarose and agaropectin used for culture media for microbiological work.

Biological Drawing: a technical illustration used to visually communicate the structure and specific details of biological aspects of study.

Bioremediation: a process used to treat contaminated media including water, soil and subsurface material by altering environmental conditions to stimulate growth of microorganisms and degrade target pollutants.

Biosurvey: or biological survey, is a scientific study of organisms to assess the condition of an ecological resource, usually with the purpose of informing land use or wildlife management.

Biotic: the living components of a community, for example organisms, such as animals and plants.

Eukaryotic: organisms whose cells have a nucleus enclosed within membranes; members of the domain Eukaryota.

Incubator: a device used to grow and maintain microbiological cultures or cell cultures by maintaining optimal temperature, humidity and other conditions such as carbon dioxide and oxygen content of the atmosphere inside.

Innocuous: harmless.

Microscope: an instrument used to see objects that are too small to be seen by the naked eye.

Pathogen: a disease-causing microorganism.

Prokaryotic: organisms lacking a membrane bound nucleus; members of the domains Archaea or Bacteria.

Quadrat: a frame, traditionally square, used in ecology and geography to isolate a standard unit of areas for study of the distribution of an item over a large area.

Secwepemc: a First Nations group, known in English as the Shuswap people, residing in British Columbia in a territory extending to the Chilcotin, Cariboo, Thompson, Shuswap, and Columbia Valley; this territory covers approximately 145,000 square kilometers. Secwepemcstin is the spoken language of the Secwepemc people.

Unicellular: organisms that consists of only one cell.

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